JAPANESE [JP,2002-280237,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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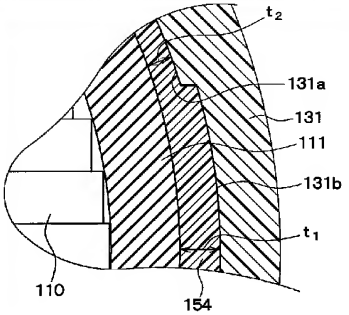
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the ignition coil for internal-combustion engines (it abbreviates to an ignition coil hereafter.).
[0002]
[Description of the Prior Art]The structure of the ignition coil for cars, for example to JP,11-111545,A like a statement, Although it comprises a resin material (a potting material, casting resin) etc. with which the crevice between the primary coil (periphery side coil) and secondary coil (inner circumference side coil) which have been arranged on the same axle at the periphery side of a cylindrical center core, and the parts of these plurality was filled up, Since the coefficient of linear expansion of these component parts is different, respectively, a possibility that a crack (crack) will occur in component parts with heat stress is high.
[0003]In view of the point describing above, this invention is in the ignition coil for internal-combustion engines, and an object of this invention is to control generating of the crack by heat stress.

Drawing selection Representative draw



110：中心コア　130：二次コイル（内周側コイル）
131：二次スプール（巻枠）　154：樹脂層

[Translation done.]

[0004]
[Means for Solving the Problem]This invention to achieve the above objects in the invention according to claim 1. A center core (110) which is an ignition coil for internal-combustion engines which supplies high tension to an ignition of an internal-combustion engine, and was formed in the shape of an approximate circle pillar, The inner circumference side coil (130) rolled on the same axle to a center core (110), and the periphery side coil (120), It has a resin layer (154) which consists of a resin material which has the electric insulation filled up with a peripheral face of a center core (110) by a wrap tube (111), the inner circumference side coil (130) and a tube (111), and crevice between between, A center core (110) is constituted by laminating a thin band board (110a) which consists of magnetic materials to a diameter direction of a center core (110), Compared with other parts, it is characterized near the thin band board (110a) with which a width dimension serves as the maximum among resin layers (154) by thickness of a resin layer being thick.
[0005]By the way, since the coefficient of linear expansion of a resin layer (154) is small compared with a coefficient of linear expansion of a center core (110), heat stress by a difference in a coefficient of linear expansion (thermal expansion amount) will concentrate on an edge part (corner) of a center core (110). And this heat stress becomes the largest [near / a thermal expansion amount is most greatly different from / the thin band board (110a) with which a width dimension serves as the maximum].
[0006]Therefore, if thickness of a resin layer [/ near the thin band board (110a) with which a width dimension serves as the maximum like the invention according to claim 1] (154) thickens compared with thickness of a resin layer (154) of other parts, a crack can be beforehand prevented from occurring in a resin layer (154) etc.
[0007]A center core (110) which is an ignition coil for internal-combustion engines which supplies high tension to an ignition of an internal-combustion engine, and was formed in the shape of an approximate circle pillar in the invention according to claim 2, The inner circumference side coil (130) rolled on the same axle to a center core (110), and the periphery side coil (120), A spool (131) for coiling winding of the inner circumference side coil (130) which was allocated in the wrap tube (111) and inner circumference side of the inner circumference side coil (130), and was formed approximately cylindrical in a peripheral face of a center core (110), Have a resin layer (154) which consists of a spool (131), a tube (111), and a resin material that has the electric insulation with which a crevice between between was filled up, and a center core

(110), It is constituted by laminating a thin band board (110a) which consists of magnetic materials to a diameter direction of a center core (110), Near the thin band board (110a) with which a width dimension serves as the maximum among inner skin (131a) of a spool (131), shaft orientations of a center core (110) and a slot (131b) which extends in parallel are provided.

[0008]Since thickness of a resin layer [/ near the thin band board (110a) with which a width dimension serves as the maximum] (154) becomes thick by this compared with thickness of a resin layer (154) of other parts, a crack can be beforehand prevented from occurring in a resin layer (154) etc. like the invention according to claim 1.

[0009]By the way, since a center core (110) supposes that it is cylindrical by laminating a thin band board (110a), since [that it is fine] it becomes stair-like, a very small opening will generate the peripheral face.

[0010]On the other hand, since very high voltage has occurred in a coil, it is easy to generate corona discharge in the aforementioned very small opening located between a center core (110) (especially the edge part) and a coil which are conductors. And generating of corona discharge will wear a tube (111) so that a center electrode and an earth electrode of a spark plug may be worn out.

[0011]So, in the invention according to claim 3, a peripheral face of a center core (110) a wrap tube (111), While constituting the outside of the inner circumference side tube (111a) located in the center core (110) side, and this inner circumference side tube (111a) from a wrap periphery side tube (111b), The periphery side tube (111b) is characterized by being a shrinkable tube which a diameter dimension reduces, and the inner circumference side tube (111a) being a tube made of resin which will be in a molten state at temperature to which the periphery side tube (111b) is made to reduce by being heated.

[0012]Since a very small opening generated between a tube (111) and the center core 110 is filled with resin (inner circumference side tube (111a)) of a molten state by this, it can control that corona discharge occurs in a very small opening generated between a tube (111) and a center core (110).

[0013]Therefore, since a tube (111) can be prevented from wearing out by corona discharge generated in a very small opening, high electric insulation between a coil and a center core (110) is maintainable.

[0014]A center core (110) which is an ignition coil for internal-combustion engines which supplies high tension to an ignition of an internal-combustion engine, and was formed in the shape of an approximate circle pillar in the invention according to claim 4, The inner circumference

side coil (130) rolled on the same axle to a center core (110), and the periphery side coil (120), Contact a center core (110), have a peripheral face of a center core (110), and a wrap tube (111) a center core (110), It is constituted by laminating a thin band board (110a) which consists of magnetic materials to a diameter direction of a center core (110), and at least the periphery side of a tube (111), It fills up with a resin material which has electric insulation, a resin layer (154) is formed, and a tube (111) has conductivity further.

[0015]Since a tube (111) serves as a center core (110) and same electric potential by this, when it sees from a coil, a center core (110) is visible to a simple cylindrical core in which an edge part and a very small opening do not exist.

[0016]Therefore, it can control that corona discharge occurs, and since a tube (111) can be prevented from wearing out, high electric insulation between a coil and a center core (110) is maintainable.

[0017]By the way, other members to which, as for a resin layer, (154) usually contacts this (in this example.) Since it will be in the state where it pasted up very firmly with a secondary spool (131), If a crack occurs in a resin layer (154) with heat stress [/ in the case of a coefficient of linear expansion (thermal expansion amount)], it will be divided with a resin layer (154) which this crack generated, and a resin layer (154) in which a crack also generated a pasted-up member (secondary spool (131)) (it will ******).

[0018]Then, a center core (110) formed in the shape of an approximate circle pillar in the invention according to claim 5, The inner circumference side coil (130) rolled on the same axle to a center core (110), and the periphery side coil (120), A spool (131) made of resin around which it was allocated in the wrap tube (111) and inner circumference side of the inner circumference side coil (130), and winding of the inner circumference side coil (130) was coiled in a peripheral face of a center core (110), It has a resin layer (154) which consists of a spool (131), a tube (111), and a resin material that has the electric insulation with which a crevice between between was filled up, and an elastic member (154a) in which elastic deformation is possible is allocated between a resin layer (154) and a spool (131).

[0019]Since a resin layer (154) can carry out a relative displacement to inner skin of a secondary spool (131) even if a crack generated in a resin layer (154) occurs by this, growth of a crack generated in a resin layer (154) is dammed up in an elastic member (154a). Therefore, a secondary spool (131) can prevent being divided with a resin layer (154).

[0020]A center core (110) formed in the shape of an approximate circle pillar by laminating a thin band board

(110a) which consists of magnetic materials in the invention according to claim 6, The peripheral face side of a center core (110) A color (111c) of wrap cylindrical shape, A shrinkable tube (111) which covers the peripheral face side in color (111c), and a diameter dimension reduces by being heated, It has the inner circumference side coil (130) which was located in the periphery side and rolled from a contraction tube (111) on the same axle to a center core (110), and the periphery side coil (120).

[0021]since it can control by this that heat stress concentrates on an edge part of a center core (110), a crack can be beforehand prevented from resembling a resin layer (154) etc. and occurring.

[0022]A center core (110) formed in the shape of an approximate circle pillar by laminating a thin band board (110a) which consists of magnetic materials in the invention according to claim 7, The peripheral face side of a center core (110) is located in the periphery side from a wrap tube (111) and a tube (111), A slit (110b) which has the inner circumference side coil (130) rolled on the same axle to a center core (110) and the periphery side coil (120), divides some thin band boards (110a) to a thin band board (110a), and is prolonged in a longitudinal direction is provided.

[0023]By this, since elasticity of the cross direction (direction which intersects perpendicularly with a longitudinal direction) of a thin band board (110a) accompanying a temperature change is absorbable to a slit (110b), It can control that heat stress concentrates on an edge part, and a crack can be beforehand prevented from occurring in a resin layer (154) etc.

[0024]By the way, by thermal expansion of a longitudinal direction, since the both-ends side is joined, it turns at a center core (110) to a bow so that a longitudinal direction center section may be displaced most greatly. For this reason, a member located in the periphery side of a center core (110) receives the biggest heat stress in a longitudinal direction center section of the center core (110) displaced most greatly.

[0025]Then, a center core (110) formed in the shape of an approximate circle pillar in the invention according to claim 8, From a center core (110), it is located in the periphery side, have the inner circumference side coil (130) rolled on the same axle to a center core (110), and the periphery side coil (120), and a center core (110), It is constituted by arranging in shaft orientations two or more core parts (110c) to which a thin band board (110a) which consists of magnetic materials was laminated, and the longitudinal direction end was joined.

[0026]Thereby, a longitudinal direction size of a thin plate material (110a) becomes small, and maximum displacement

by thermal expansion of a longitudinal direction can make it small compared with what constituted a center core (110) with one core part (110c).
[0027]Therefore, since heat stress which acts on a member located in the periphery side of a center core (110) can be eased, a crack can be beforehand prevented from occurring in a member located in the periphery side of a center core (110).
[0028]In the invention according to claim 9, a laminating direction of a thin band board (110a) in a core part (110c) of one and a laminating direction of a thin band board (110a) in other core parts (110c) are different among two or more core parts (110c).
[0029]direction of heat stress which acts on a member located in the periphery side of a center core (110) in connection with thermal expansion of a longitudinal direction by this -- a core part (110c) of 1, and other core parts (110c) -- it can be made different
[0030]Therefore, since heat stress which acts on a member located in the periphery side of a center core (110) can be distributed, a crack can be beforehand prevented from occurring in a member located in the periphery side of the center core 110.
[0031]A center core (110) formed in the shape of an approximate circle pillar in the invention according to claim 10, The inner circumference side coil (130) which was located in the periphery side and rolled from a center core (110) on the same axle to a center core (110), and the periphery side coil (120), It has a resin layer (154) which consists of a resin material with which a crevice between a center core (110) and the inner circumference side coil (130) was filled up, and a filler which increases a mechanical strength of a resin layer (154) is added by resin layer (154).
[0032]It can control that a crack occurs in a resin layer (154) which consists of a resin material with which a crevice between a center core (110) and the inner circumference side coil (130) was filled up by this.
[0033]By the way, since coiled winding collapses easily when coiling winding, in order for a bias volume to prevent this volume collapse, when coiling winding by making the shape of a cross section shape of a secondary spool (131) into a polygon, it is desirable to make it winding eat into a secondary spool (131).
[0034]However, if the shape of a cross section shape of a secondary spool (131) is made into a polygon, when fabricating a secondary spool (131), compared with simple circular section outline shape, it is easy to generate disorder in a resin streak. And if disorder occurs in a resin streak, orientation of a resin material which forms a secondary spool (131) will be in disorder, and a mechanical strength of

a secondary spool (131) will fall easily.
[0035]On the other hand, since the shaft-orientations other end side of a secondary spool (131) is firmly restrained in a flange (152) compared with the axial end side, it tends to generate big heat stress. For this reason, in the shaft-orientations other end side of a secondary spool (131), it is easy to generate a crack by heat stress.
[0036]Then, a primary coil (120) and a secondary coil (130) which have been arranged on the same axle in the invention according to claim 11, A center core (110) inserted in an axis part of both coils (120, 130), An approximately cylindrical primary spool (121) which winding of a primary coil (120) was coiled and was fabricated by resin, An approximately cylindrical secondary spool (131) which winding of a secondary coil (130) was coiled and was fabricated in a product made of resin, A center core (110) and cylindrical housing (151) which stores both coils (120, 130), Have the bracket part (152) for immobilization provided so that the axial end side of housing might be covered, and winding of a secondary coil (130), Potential difference between adjacent winding is rolled in a bias volume made small, and further, the shape of a cross section shape by the side of an axial end is an approximate circle form among secondary spools (131), and, on the other hand, it is characterized by the shape of a cross section shape by the side of the shaft-orientations other end being a polygon.
[0037]Thereby, a crack can be prevented from occurring in a secondary spool (131), preventing volume collapse.
[0038]A primary coil (120) and a secondary coil (130) which have been arranged on the same axle in the invention according to claim 12, A center core (110) inserted in an axis part of both coils (120, 130), An approximately cylindrical primary spool (121) which winding of a primary coil (120) was coiled and was fabricated by resin, An approximately cylindrical secondary spool (131) which winding of a secondary coil (130) was coiled and was fabricated in a product made of resin, A center core (110) and cylindrical housing (151) which stores both coils (120, 130), Have the bracket part (152) for immobilization provided so that the axial end side of housing might be covered, and winding of a secondary coil (130), It changes from an approximate circle form to a polygon gradually, so that potential difference between adjacent winding is rolled in a bias volume made small and the shape of a cross section shape of a secondary spool (131) goes to the other end side from the axial end side further.
[0039]Thereby, a crack can be prevented from occurring in a secondary spool (131) like the invention according to claim 11, preventing volume collapse.
[0040]Incidentally, numerals in a parenthesis of each above-

mentioned means are examples which show a correspondence relation with a concrete means of a statement to an embodiment mentioned later.

[0041]

[Embodiment of the Invention](A 1st embodiment) This embodiment the ignition coil concerning this invention Voltage high to the spark plug (ignition) of the engine for vehicle running (internal-combustion engine). It applies to the ignition coil for vehicles which supplies (for example, 30 kV), drawing 1 is an axial sectional view (whole sectional view) of the ignition coil 100 concerning this embodiment, and drawing 2 is an A-A sectional view of drawing 1.

[0042]Incidentally, the ignition coil 100 concerning this embodiment is constituted in the shape of a stick (stick), the spark plug (not shown) is equipped with it, and this ignition coil 100 is accommodated in the plughole formed in the cylinder head (not shown).

[0043]The inside of drawing 1 and 110 are magnetic materials (according to this embodiment.). It is a cylindrical center core which consists of silicon sheets, and this center core 110 is a lamination core constituted by laminating two or more thin band boards 110a from which it extends in direction abbreviation parallel (space perpendicular direction) of a magnetic field, and the width dimension W is different to that thickness direction, as shown in drawing 2.

[0044]As for the longitudinal direction both-ends side of the center core 110, while each thin band board 110a is welded in laser welding, the permanent magnets 112 and 113 which have direction of the magnetic field induced with the primary coil 120 mentioned later and the polarity for reverse are allocated in the end side.

[0045]And the secondary coil (inner circumference side coil) 130 electrically connected to the periphery side of the center core 110 at the spark-plug side is arranged, The primary coil (periphery side coil) 120 by which the control signal from the igniter which controls the high tension generated in the secondary coil 130 is inputted into the outside of this secondary coil 130 is arranged.

[0046]121 is a primary spool (periphery side reel) for coiling the winding of the primary coil 120 allocated between the secondary coil 130 and the primary coil 120, and this primary spool 121 is formed approximately cylindrical with electrical insulation materials, such as resin (this embodiment PPE resin).

[0047]And in the peripheral face (between the primary coil 120 and the primary spools 121) of the primary spool 121. The thin film film 122 which consists of PETs (polyethylene terephthalate) is rolled, and the 1st adhesion restraining

layer in which the primary spool 121 and the resin for molds (casting resin) mentioned later prevent pasting up thoroughly by this thin film film 122 is constituted.
[0048]131 is a secondary spool (inner circumference side reel) for coiling the winding of the secondary coil 130 allocated between the secondary coil 130 and the center core 110, and this secondary spool 131 is formed approximately cylindrical with electrical insulation materials, such as resin (this embodiment PPE resin).
[0049]Since the ignition coil 100 carries out pressure up of the voltage inputted into the primary coil 120 and outputs it from the secondary coil 130, the number of turns of the secondary coil 130, While making it more than the number of turns of the primary yl 120, the wire size of the winding of the secondary coil 130 is made smaller than the wire size of the winding of the primary coil 120, and the winding of the secondary coil 130 is coiled around the secondary spool 131 in the bias volume.
[0050]As it is indicated in drawing 3 as a "bias volume", here so that it may move in a zigzag direction in the direction of slanting to a space sliding direction (diameter direction of a spool), turning winding to the other end side from the axial end side of a spool -- also winding -- it is how to wind, and since the winding length between adjacent winding will become short if winding is coiled around a spool by this "bias volume", potential difference between adjacent winding can be made small.
[0051]Incidentally, the secondary coil 130 is rolled so that it goes to the high-tension side (the spark-plug side among [This embodiment] the axial ends of the secondary coil 130), and the thickness (volume number of stages of a coil) of a coil may decrease.
[0052]To the inner skin side (between the secondary spool 131 and the center cores 110) of the secondary spool 131. As shown in drawing 2, the buffer member (this embodiment tube made of rubber) 111 which prevents the edge part (corner) of the center core 110 from contacting the secondary spool 131 directly is allocated.
[0053]Incidentally, the buffer member (contraction tube) 111 is sticking the buffer member (contraction tube) 111 to the center core 110 by being heated by a diameter dimension's contracting, and heating, where the center core 110 is inserted into the buffer member (contraction tube) 111.
[0054]The tubed peripheral core 140 which consists of magnetic materials (this embodiment silicon sheet) is allocated in the periphery side of the primary coil 120, the periphery side of this peripheral core 140 is covered with the housing 150 made of resin (protected), and it is ******.
[0055]As shown in drawing 1, the housing 150 comprises a

portion of three outlines and specifically, The 1st housing part 151 that covers the periphery side of the peripheral core 140 and protects an ignition coil body part (part in which the primary coil 120 and the secondary-coil 130 grade were accommodated), the axial end side (space upper part side) of the 1st housing part 151 -- a wrap -- it being made like and, The 2nd housing part 152 with which the bracket part 161 for fixing to a cam cover (not shown) the connector area 160 and the ignition coil 100 to which the cable (not shown) from an igniter is connected was united, The leading line provided in the axial end of the secondary coil 130. (it does not illustrate.) -- the 1st high tension terminal 171 connected. And it consists of the 3rd housing part (high voltage tower) 153 by which the 2nd high tension terminal 173 grade which electrically connects the spring 172 which consists of a conductive material in contact with the terminal of the 1st high tension terminal 171 and a spark plug (relay) was stored.

[0056]And in the housing 150 (especially inside of the peripheral core 140), the resin layer 154 which is filled up with the casting resin (this embodiment epoxy system resin) which has electric insulation and in which both the coils 120 and 130 and other parts carry out mold immobilization is formed.

[0057]At this time, near the thin band board 110a with which the width dimension W serves as the maximum among the inner skin 131a of the secondary spool 131, as shown in drawing 4, when the shaft orientations of the center core 110 and the slot 131b which extends in parallel (space perpendicular direction) provide, the thickness t1 of the resin layer [/ near the thin band board 110a with which the width dimension W serves as the maximum] 154 becomes thick compared with the thickness t2 of the resin layer 154 of other parts (t1>t2) -- it is made like.

[0058]Next, the feature (operation effect) of this embodiment is described.

[0059]Since the coefficient of linear expansion of the resin layer 154 is small compared with the coefficient of linear expansion of the center core 110, the heat stress by the difference in a coefficient of linear expansion (thermal expansion amount) will concentrate on the edge part (corner) of the center core 110. And this heat stress becomes the largest [near / a thermal expansion amount is most greatly different from / the thin band board 110a with which the width dimension W serves as the maximum].

[0060]On the other hand, since the thickness t1 of the resin layer [/ near the thin band board 110a with which the width dimension W serves as the maximum] 154 thickens in this embodiment compared with the thickness t2 of the resin layer 154 of other parts, A crack can be beforehand

prevented from occurring in the secondary spool 131 which stands in a row in the resin layer 154 and this.

[0061](A 2nd embodiment) As shown in drawing 5 (a), this embodiment the buffer member (contraction tube) 111, While making the outside of the inner circumference side tube 111a located in the center core 110, and this inner circumference side tube 111a into the two-layer structure which consists of the wrap periphery side tube 111b, By being heated, a diameter dimension shall contract and the periphery side tube 111b makes the inner circumference side tube 111a the product made of resin which will be in a molten state at the temperature to which the periphery side tube 111b is made to reduce.

[0062]Next, the feature (operation effect) of this embodiment is described.

[0063]Since the center core 110 supposes that it is cylindrical by laminating the thin band board 110a, as shown in drawing 2, since [that it is fine] it becomes stair-like, a very small opening will generate the peripheral face.

[0064]On the other hand, since voltage very high like the above-mentioned has occurred in the secondary coil 130, it is easy to generate corona discharge in the aforementioned very small opening located between the center core 110 (especially the edge part) and the secondary coil 130 which are conductors. And generating of corona discharge will wear the buffer member (contraction tube) 111 so that the center electrode and earth electrode of the spark plug may be worn out.

[0065]On the other hand, when carrying out heat shrinking of the buffer member (contraction tube) 111 in this embodiment, Since the very small opening generated between the buffer member (contraction tube) 111 and the center core 110 is filled with resin (inner circumference side tube 111a) of a molten state, It can control that corona discharge occurs in the very small opening generated between the buffer member (contraction tube) 111 and the center core 110.

[0066]Therefore, since the buffer member (contraction tube) 111 can be prevented from wearing out by the corona discharge generated in a very small opening, the high electric insulation between the secondary coil 130 and the center core 110 is maintainable.

[0067](A 3rd embodiment) This embodiment is also aimed at controlling that corona discharge occurs like a 2nd embodiment in the very small opening generated between the buffer member (contraction tube) 111 and the center core 110.

[0068]As shown in drawing 6 (a), specifically the buffer member (contraction tube) 111, While making the outside of the inner circumference side tube 111a located in the center

core 110, and this inner circumference side tube 111a into the two-layer structure which consists of the wrap periphery side tube 111b, By being heated, a diameter dimension shall contract and the periphery side tube 111b makes the inner circumference side tube 111a the product made of conductive resin (resin which mixed conducting materials, such as carbon and metal).

[0069]Since the inner circumference side tube 111a (buffer member 111) serves as the center core 110 and same electric potential by this, when it sees from the secondary coil 130, as shown in drawing 6 (b), the center core 110 is visible to the simple cylindrical core in which an edge part and a very small opening do not exist.

[0070]Therefore, since it can control that corona discharge occurs, the buffer member (contraction tube) 111 can be prevented from wearing out, and the high electric insulation between the secondary coil 130 and the center core 110 can be maintained.

[0071]Although the inner circumference side tube 111a was used as conductive resin in this embodiment, A diameter dimension shall reduce this embodiment by not being limited to this and heating the inside-and-outside circumference side tube 111a, for example. And the periphery side tube 111b is made into the product made of conductive resin, or buffer member 111 itself may be further made into the product made of conductive resin by making the buffer member (contraction tube) 111 into structure.

[0072](A 4th embodiment) This embodiment allocates the elastic member 154a in which elastic deformation, such as rubber and an elastomer, is possible between the resin layer 154 and the secondary spool 131 which were formed in the periphery side of the buffer member (contraction tube) 111, as shown in drawing 7 (a).

[0073]Next, the feature (operation effect) of this embodiment is described.

[0074]Usually, other members to which, as for a resin layer, 154 contacts this (in this example.) Since it will be in the state where it pasted up very firmly with the secondary spool 131, if a crack occurs in the resin layer 154 with heat stress [/ in the case of a coefficient of linear expansion (thermal expansion amount)], It is divided with the resin layer 154 which this crack generated, and the resin layer 154 in which the crack also generated the pasted-up member (it will ******).

[0075]On the other hand, since the elastic member 154a in which elastic deformation, such as rubber and an elastomer, is possible is allocated between the resin layer 154 and the secondary spool 131 in this embodiment, As shown in drawing 7 (b), even if the crack generated in the resin layer 154 occurs, the resin layer 154 can carry out a relative

displacement to the inner skin of the secondary spool 131.
[0076]Therefore, since growth of the crack generated in the resin layer 154 is dammed up by the elastic member 154a, the secondary spool 131 can prevent being divided with the resin layer 154.
[0077](A 5th embodiment) As shown in drawing 8, this embodiment by allocating the approximately cylindrical color 111c between the buffer member (contraction tube) 111 and the center core 110, The peripheral face of the center core 110 is covered in the color 111c, and let the periphery side of the color 111c be wrap structure by the buffer member (contraction tube) 111.
[0078]A crack can be beforehand prevented from being able to control that heat stress concentrates on an edge part, and occurring in the resin layer 154 or the secondary spool 131 by composition described above, since it becomes the structure where the edge part of the center core 110 was covered in the color 111c.
[0079]While the color 111c is fabricated in this embodiment by metal, resin, etc. whose mechanical strength is higher than the buffer member (contraction tube) 111, As shown in drawing 8 (b), the color 111c is raising the wearing nature (insertion nature) to the center core 110 of the color 111c by making sectional shape of the color 111c into C type, as the diameter dimension can carry out expansion modification easily.
[0080](A 6th embodiment) As shown in drawing 9, this embodiment forms the slit 110b which divides some thin band boards 110a which the center core 110 constitutes, and is prolonged in a longitudinal direction, and makes the thin band board 110a the shape of a tuning fork.
[0081]By this, since elasticity of the cross direction (direction which intersects perpendicularly with a longitudinal direction) of the thin band board 110a accompanying a temperature change is absorbable to the slit 110b, It can control that heat stress concentrates on an edge part, and a crack can be beforehand prevented from occurring in the resin layer 154 or the secondary spool 131.
[0082](A 7th embodiment) Two or more [by which the thin band board 110a was laminated and laser junction of the longitudinal direction end was carried out as this embodiment was shown in drawing 10] (according to this embodiment.) While comparing so that the two core parts 110c may be arranged in shaft orientations, The laminating direction of the thin band board 110a in the core part 110c of one and the laminating direction of the thin band board 110a in other core parts 110c are made different among two or more core parts 110c (this embodiment about 90 degrees), and the center core 110 is constituted.
[0083]Next, the feature (operation effect) of this

embodiment is described.
[0084]Since the both-ends side is welded, it turns at the center core 110 (the core part 110c is also included.) to a bow by the thermal expansion of a longitudinal direction so that a longitudinal direction center section may be displaced most greatly. For this reason, the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110 receives the biggest heat stress in the longitudinal direction center section of the center core 110 (the core part 110c is also included.) displaced most greatly.
[0085]On the other hand, at this embodiment, it is [two or more / (according to this embodiment.)]. Since the center core 110 is constituted by arranging the two core parts 110c in shaft orientations, The longitudinal direction size of the thin plate material 110a becomes small, and the maximum displacement by the thermal expansion of a longitudinal direction can make it small compared with what constituted the center core 110 with the one core part 110c.
[0086]Therefore, since the heat stress which acts on the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110 can be eased, A crack can be beforehand prevented from occurring in the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110.
[0087]Since the laminating direction of the thin band board 110a in the core part 110c of one and the laminating direction of the thin band board 110a in other core parts 110c are made different among two or more core parts 110c, The direction of heat stress which acts on the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110 in connection with the thermal expansion of a longitudinal direction can be made different in the core part 110c of 1, and other core parts 110c.
[0088]Therefore, since the heat stress which acts on the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110 can be distributed, A crack can be beforehand prevented from occurring in the member (especially the secondary spool 131 and the resin layer 154) located in the periphery side of the center core 110.
[0089](An 8th embodiment) This embodiment is made paying attention to the point in which it is difficult to thicken thickness of the resin layer 154 formed between the center core 110 and the secondary coil 130.
[0090]The filler (this embodiment glass fiber) which specifically increases the mechanical strength of the resin layer 154 to the resin layer 154 formed between the center

core 110 and the secondary coil 130 is added.
[0091]As shown in drawing 11, it is filled up with the resin layer 154 by which this filler was added in the secondary spool 131 fabricated in the shape of a filler ** glass, and it is fabricated by being filled up with a resin material (potting material) after that.
[0092](A 9th embodiment) It is made for this embodiment to change from an approximate circle form to a polygon gradually, so that the shape of a cross section shape of the secondary spool 131 goes to the other end side (2nd housing 152 side) from the axial end side (spark-plug side), as shown in drawing 12.
[0093]Next, the feature (operation effect) of this embodiment is described.
[0094]The winding of the secondary coil 130 is coiled in the bias volume, as a 1st embodiment described, but. Since the coiled winding collapses easily when coiling winding, in order for a bias volume to prevent this volume collapse, when coiling winding by making the shape of a cross section shape of the secondary spool 131 into a polygon, it is desirable to make it winding eat into the secondary spool 131.
[0095]However, if the shape of a cross section shape of the secondary spool 131 is made into a polygon, when fabricating the secondary spool 131 by an injection molding method etc., compared with simple circular section outline shape, it is easy to generate disorder in a resin streak. And if disorder occurs in a resin streak, the orientation of the resin material which forms the secondary spool 131 will be in disorder, and the mechanical strength of the secondary spool 131 will fall easily.
[0096]On the other hand, since the shaft-orientations other end side (low-tension side) of the secondary spool 131 is firmly restrained with the 2nd housing 152 compared with the axial end side (spark-plug side), it tends to generate big heat stress. For this reason, in the shaft-orientations other end side (low-tension side) of the secondary spool 131, it is easy to generate the crack by heat stress.
[0097]On the other hand, since the shape of a cross section shape by the side of the axial end which a crack (big heat stress) tends to generate among the secondary spools 131 is an approximate circle form in this embodiment and the shape of a cross section shape by the side of the shaft-orientations other end is a polygon on the other hand, A crack can be prevented from occurring in the secondary spool 131, preventing volume collapse.
[0098](Other embodiments) although the inner circumference side was a secondary coil and the periphery side was a primary coil in the above-mentioned embodiment, this invention may be limited to this, and uses

the periphery [not a thing but] side as a secondary coil, and its inner circumference side is good also as a primary coil.

[Translation done.]